# DG-1145: Combined License Applications for Nuclear Power Plants (LWR Edition)

**Office of Nuclear Reactor Regulation**
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# Section C.I.7, Instrumentation and Controls

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Sikhindra K.(S.K) Mitra,
U.S. Nuclear Regulatory Commission
Division of New Reactor Licensing

## Overview

- Section rationale and basis
- Section references
- Chapter C.1.7 highlights
- C.III.1 & 2
- Pre-Workshop Comments

## Rationale and Basis

- Rationale:
  - Provide guidance for 10 CFR Part 52 applicants
- Technical basis/input from:
  - Regulatory Guide 1.70 REV 3, NOV, 1978
  - Draft update to Section 7 of Standard Review Plan (NUREG-0800)
  - NEI 04-01E input

# Rationale and Basis

- Regulatory Requirement: 10 CFR 50, Appendix A , General Design Criteria
- Regulatory Requirement : 10 CFR 50.55a(h)
- I & C Design should meet IEEE – 603, Application should demonstrate how the design meets every criteria
- I & C Software Design should meet IEEE-7-4.3.2, Application should demonstrate how the design meets every criteria
- SRP BTP 7-14 provides guidance on I & C design process
- SRP BTP 7-19 provides guidance on protection against Common-Cause failure

## Section References

The I & C Systems should be addressed in the following Sections:

7.1 Introductions
7.2 Reactor Trip Systems
7.3 Engineered Safety Features Actuation Systems
7.4 Safe Shutdown Systems
7.5 Safety-Related Display Instrumentation
7.6 Interlock Systems Important to Safety
7.7 Control systems
7.8 Diverse I & C Systems
7.9 Data Communication Systems

# Section C.I.7, Instrumentation and Controls

Each section should provide:

- System Description
- Design - Basis Information
- Analysis

## COL Applications Referencing a Certified Design or Certified Design & Early Site Permit

- Section C.III.1, Chapter 7: Application referencing CD provide additional information summarized below:
  - Basic deign discussed in CD DCD
  - Design related ITAAC addressed in C.III.5
  - Any item departs from CD should follow the guidance stated in Section C.III.1.6
- Section C.III.2, Chapter 7: Application referencing CD & ESP

  Note: COL applicants need to provide additional information identical to that identified in C.III.1, Chapter 7.

## Section C.I.18, Human Factors Engineering: OVERVIEW

- Section rationale and basis
- Section references
- Chapter 18 highlights
- Selected Technical Branch insights
- What if DC or DC&ESP are referenced?
- Pre-Workshop Comments
- Q&A, Additional Discussion

## Section C.I.18, Human Factors Engineering: Rationale & Basis

- Rationale:
  - Provide guidance for 10 CFR Part 52 applicants.
- Technical basis/input from:
  - NUREG-0711 Human Factors Engineering Program Review Model

## Section C.I.18, Human Factors Engineering: References

- 10 CFR Parts 34, 50, 52, 55
- Regulatory Guides
- NUREGS, NUREG/CRs
- Commission Papers
- ANSI Standards

## Section C.I.18, Human Factors Engineering: Highlights

- Developed by staff & supporting laboratory using latest available references
- Emphasis on the 12 NUREG-0711 elements
- Recognition of potential for variation in levels of "completeness" from DCD to DCD & applicant to applicant
- Type of information to be submitted consistent, whether by reference to DCD or in COL application (FSAR & referenced docs)

## Section C.I.18, Human Factors Engineering: Highlights (cont'd)

- Describe how Human Factors Engineering (HFE) principles are incorporated into:
  - (1) the planning and management of HFE activities;
  - (2) the plant design process;
  - (3) the characteristics, features, and functions of the human-system interfaces (HSIs), procedures, and training; and
  - (4) the implementation of the design and monitoring changes to the design at the site.

## Section C.I.18, Human Factors Engineering: Highlights (cont'd)

- The chapter should illustrate how human characteristics and capabilities are successfully integrated into the nuclear power plant design, in such a way that they result in a state-of-the-art design and support successful performance of the required job tasks by plant personnel.
- The FSAR should address the 12 HFE elements

## Section C.I.18, Human Factors Engineering: Highlights (cont'd) THE 12 ELEMENTS

- HFE Program Mgmt
- Op. Experience Review
- Functional Reqts Analysis & Allocation
- Task Analysis
- Staffing & Qualifications
- Human Reliability Analysis
- Human-System Interface Design
- Procedure Development
- Training Prog Devl.
- Human Factors Verification & Validation
- Design Implementation.
- Human Performance Monitoring

## Section C.I.18, Human Factors Engineering: Highlights (cont'd)

- For each element, the FSAR should describe:
  - the objectives and scope of the applicant's activities related to the element,
  - the methodology used to perform the analyses, and
  - the results of the analyses.
- In MOST Sections, COL Applicant may **summarize** the information & **reference** the location of the detailed information

## Section C.I.18, Human Factors Engineering: Highlights (cont'd)

- For HFE elements not completed at time of COL application:
  - Describe the element as completely as possible in FSAR to allow staff determination of "reasonable assurance"
  - Provide an Implementation Plan describing scope & objectives of the element & a detailed description of the methodology for conduct of the analyses
- Submittal of other supporting documents is encouraged

## Section C.I.18, Human Factors Engineering: Staff Perspectives

- Ch.18 did not exist in previous SAR development guidance (e.g., RG 1.70)
- DG-1145 provides an opportunity to clarify information the staff needs to conduct its review using SRP Ch.18 and NUREG-0711
- Wide variation exists in what has been included in new plant SARs (partially due to a lack of guidance)
- DG-1145 should make it easier for industry to prepare SAR Ch.18
- SRP Ch.18 and NUREG-0711 to be updated

## Section C.III.1 & 2 Ch 18, HFE: What if DC or DC&ESP is referenced?

- For each of the 12 elements, the FSAR and/or the DCD should describe the objectives and scope of the applicant's activities related to the element, the methodology used to perform the analyses, and the results of the analyses
- The degree to which a COL applicant's HFE program is already described in their design certification (DC), i.e., their Design Control Document (DCD), will dictate how much additional information is needed in the COL application

## Section C.I.18, Human Factors Engrg: Pre Workshop Comments

- C.I.18 states that "by the time of COL application submittal the first 11 elements should be complete" (p.2). This is infeasible, and it conflicts with prior understandings between industry and NRC.
- Of the 12 elements, those not completed in Design Certification are covered by DAC/ITAAC. Detailed documentation of the activities fulfilling DAC/ITAAC will not be submitted to NRC, but will be held for NRC inspection. The guidance should reflect the distinction between safety review of licensing submittals and NRC inspection of design implementation.
- C.I.18 should cite applicable documents as needed, and should not repeat, paraphrase, or revise available guidance.

# Section C.I.18, Human Factors Engrg: Pre Workshop Comments

- C.I.18 should not be used to extend NUREG-0711 guidance for Ch.18 content, scope, or analysis such as:
  - Defining individual roles in OER for all similar predecessor plants (C.I.18.2.2.2)
  - Treatment of new technologies as OER issues (C.I.18.2.2.2, .2.2.4)
  - Verification of the functional requirements analysis (C.I.18.3.2.1)
  - Verification of the function allocation... "to show that the allocations of functions result in a coherent role for plant personnel" (C.I.18.3.2.2)
  - HRA activities in excess of PRA requirements and risk-important human actions (C.I.18.6)
  - Identifying how HSI characteristics will minimize fatigue (C.I.18.7.2.5)

# Section C.I.18, Human Factors Engrg: Pre Workshop Comments

- Alternative design concepts (C.I.18.7.2.4) are not appropriate in the FSAR, and if developed, they would not be described in the FSAR. In general, much of the specific material and level of detail called for in C.I.18 is excessive and would not be contained or referenced in an FSAR, but would be held available for NRC audit.
- The term "minimum inventory" is used with two different meanings. In C.I.18.4.2 it is an outcome of Task Analysis, which implies it is the total set of HSI required for all analyzed tasks. In C.I.18.7.3.2 it refers to fixed position HSI required to support plant safety, which implies it is a subset of the total set of HSI. The staff should clarify the distinction.

## Section C.I.18, Human Factors Engineering

- **Q&A, Additional Discussion**

## Design Acceptance Criteria

- Larry Burkhart, PM, DNRL
- Background
- Purpose of DG-1145, Section C.III.5
- Content
- Comments/Questions

## Design Acceptance Criteria

- Set of prescribed limits, parameters, procedures, and attributes upon which the NRC relies, in a limited number of technical areas, in making a final safety determination to support a design certification
- Objective and must be verified as part of ITAAC performed to demonstrate that the as-built facility conforms to the certified design

## DAC Utilized

- Rad Protection (ABWR)
- I&C (all 4 certified designs)
- Human Factors Engineering (all)
- Piping (ABWR, System 80+, AP1000)

## Why DAC used?

- Providing detailed design information
  - Was not desirable due to utilization of technologies that change so rapidly that the design may have become obsolete
  - Was impractical given the unavailability of sufficient as-built, or as-procured information
- DAC implemented on a case-by-case basis

## C.III.5, Design Acceptance Criteria

- Purpose of content of this section was to encourage COL applicant to submit as early as possible detailed design information in those areas where DAC was used in the DC
  - Some bases for allowing use of DAC no longer valid
  - Allow sufficient time for staff to verify ITAAC is satisfied and not impact fuel loading schedule
  - Potential hearing in areas where DAC was used
  - To support consistency with DCRA (RIS 2006-06)

# C.III.5, DAC, Cont'd

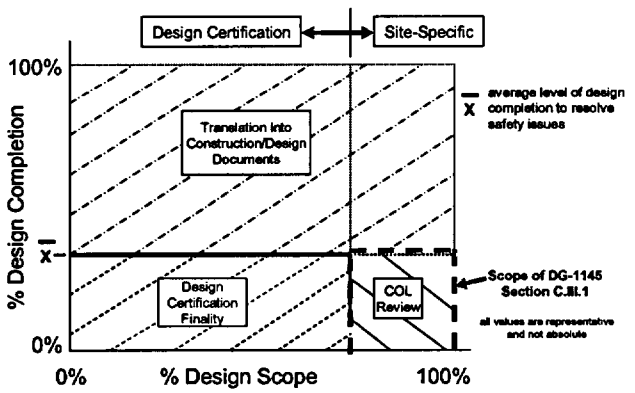
- Staff does recognize that some detailed information may still not be available during COL
  - COL applicant should identify those areas
  - And provide a schedule as to when detailed engineering, procurement, fabrication, installation, and testing will be available
- ITAAC must be met prior to fuel loading
  - Staff review of DAC-related ITAAC may necessitate verification at early stages of construction, fabrication, or development

# C.III.5, DAC, Cont'd

- Comments received
  - Unrealistic expectation of availability of detailed design information during COL
  - Submit some detailed information or have available for NRC review
  - Maintain flexibility to accommodate information review as it is available
  - RIS-2006-06 (need for changes to certified design – again, maintain flexibility)

# C.III.5, DAC

- Detailed information on what the staff would like to see re: I&C included for comment
- Staff working on the piping, radiation protection, and HFE areas
- Consistency with other sections (I&C, etc.)
- Questions/Comments




**DG-1145, Section C.III.1**
**Information Needed for a COL Application Referencing a Certified Design**
**(assumes no deviations from certified design and no design acceptance criteria)**